AMERICAN JOURNAL *of* PHARMACY

SINCE 1825

A Record of the Progress of Pharmacy and the Allied Sciences

COMMITTEE ON PUBLICATION

Charles H. LaWall, Ph. M., Sc. D. Joseph W. England, Ph. M. J. W. Sturmer, Pharm. D.
John K. Thum, Ph. M. Arno Viehoever, Ph. D. E. Fullerton Cook. Ph. M.

IVOR GRIFFITH, Ph. M., Editor
Frederick B. Kilmer, Ph. M., Special Contributor

Vol. 105 **JANUARY, 1933** **No. 1**

CONTENTS

Editorial:
1932: The Forward March of Science 1

Selected Editorial:
The Chemical Nature of Enzymes. (Reprinted From the *Journal of the American Medical Association*) 12

Original Articles:
Vitamins. By Horatio C. Wood, Jr., Philadelphia, Pa. 14

A Test for Phenols and for Copper. By Chas. C. Fulton, Minneapolis, Minn. 25

Accelerated Production of Specific Urinary Pigments by Drug Administration. II. Effect of Diethylsulfonmethylethylmethane on Urobilin and Urobilinogen Formation. By Frederic G. Germuth, Baltimore, Md. 30

Measurement of the Radiation Output of Ultra-Violet Lamps. By Ellery H. Harvey, Chicago, Ill. 36

Medical and Pharmaceutical Notes 38

News Items and Personal Notes 45

Book Reviews 47

Price $3.00 per Annum in Advance **Foreign Postage, 25 Cents Extra**

Single Numbers, 30 Cents. Back Numbers, 50 Cents

Entered as Second-Class Matter at the Post Office at Philadelphia, Pa., Under the Act of March 3, 1879

Acceptance for Mailing at Special Rate of Postage Provided for in Section 1103, Act of October 3, 1917. Authorized February 15, 1920

PUBLISHED MONTHLY BY THE

Philadelphia College of Pharmacy and Science

43d Street and Kingsessing Avenue, West Philadelphia, Pa.

ACADEMY OF NATURAL SCIENCES JAN 27 1933 OF PHILADELPHIA

American Journal of Pharmacy

ESTABLISHED IN 1825

Four preliminary numbers were published at different times until in 1829, when the publication of the regular volumes began. Since then the publication has been uninterrupted. During the period from 1829 to 1852 four numbers were published annually, except in 1847, when five numbers were published. From 1853 to 1870 six numbers were published. Since this time twelve numbers have been published annually.

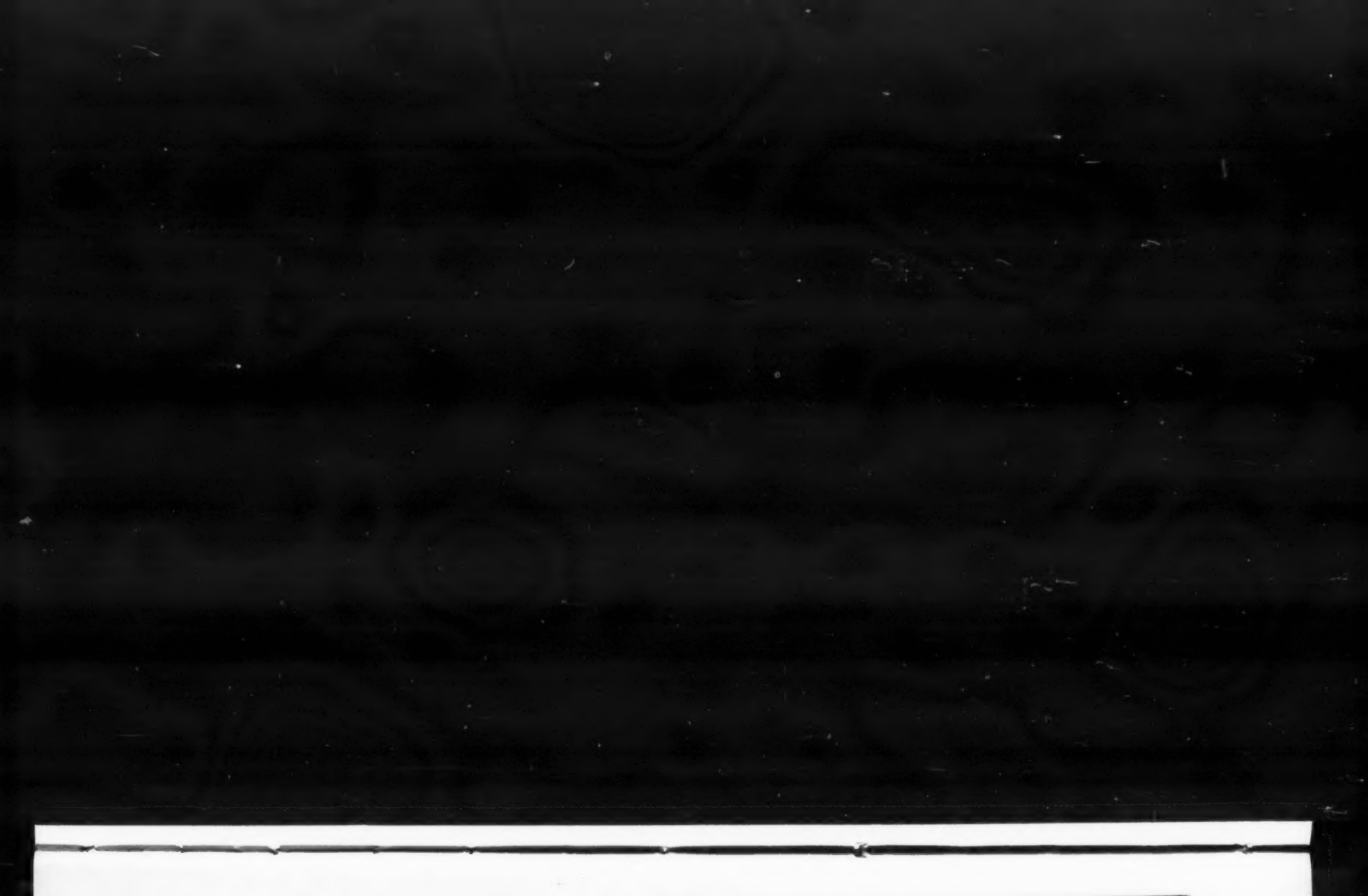
MANUSCRIPTS should be sent to the Editor. It should be stated in this connection that the Editor does not assume any responsibility in connection with the views or investigations of contributors, other than to exercise general care in the selection of matter.

Contributors are allowed a reasonable number of copies of this JOURNAL, free of charge, if applied for when the proof is returned.

REPRINTS, if desired, must be applied for when the proof is returned. The table below shows the *approximate* cost of reprints, the make-up of the pages to be identically the same as in the JOURNAL. The actual cost may vary from the figures given, and will depend upon the amount of presswork, paper, binding, etc. Reprints containing half-tones may be expected to cost somewhat more than the rates given.

COVERS WITH TITLES					2 pp.	4 pp.	8 pp.	16 pp.
25	copies.....	$1.75	25	copies.....	$2.25	$3.75	$ 7.75	$ 9.00
50	"	2.00	50	"	2.50	4.00	8.25	9.75
100	"	2.25	100	"	2.75	4.25	9.00	10.75
250	"	2.75	250	"	3.75	4.75	10.00	12.00

☞ **Our readers will find it to their advantage to carefully consult the advertising pages when desiring to correspond with STRICTLY FIRST-CLASS PARTIES.**



THE AMERICAN
JOURNAL OF PHARMACY

VOL. 105 JANUARY, 1933 NO. 1

EDITORIALS

1932

THE FORWARD MARCH OF SCIENCE

FEW indeed had kindly words to say of the year just ended. For most of us it carried little else than gloom, and grim disaster. Our progress, in some respects, was only backward, and our ledgers blushed with crimson shame upon the debit columns.

History will record it, hereabout, as the morbid year, when the depression suffered from a sudden slump.

Unemployment—bankruptcies—social crimes—suicides—bread-lines—industrial collapses—words and phrases which had formerly but slight occurrence, burdened our news columns with a nauseating frequency.

And with its going-out, slinking through the sullen shadows, it left no wisp of hope—no sound of welcome for the year-to-be.

The blessed privilege of expecting—suffered from chronicity of disappointment, and hope remained for the brave alone.

We are glad for its going—this 1932!! Glad to repeat "Wring out the old—Ring in the New!"

Yet it is not to be thought that 1932 was totally unproductive—for most certainly, Science went marching on.

Difficult as were the times,—inadequate as our application of the social sciences seem to have been—progress in the material sciences merrily marked its time. Technocracy never had a better epoch to prove its claim that material science marches faster than its social sister.

Herewith are recorded many of the discoveries and inventions that came to pass in 1932. They are compiled from the files of *Science*

ACADEMY OF NATURAL SCIENCES
JAN 27 1933
OF PHILADELPHIA

Service and other sources—and while incomplete in details—they do pronounce some little benediction on the year.

Biology

Neoplasm or "cancer" in fish was produced by the crossing of two neoplasm-free species by Prof. Myron Gordon, Cornell.

A nervous mechanism consisting of "neurohumor" secretions passing from cell to cell was reported by Dr. G. H. Parker, Harvard.

Bacteria in milk were killed by extremely high-pitched audible sound waves by Dr. Leslie A. Chambers and Prof. Newton Gaines, Texas Christian University.

Micro-motion pictures of germs show no life cycle with filtrable phase, Dr. Ralph W. G. Wyckoff, Rockefeller Institute for Medical Research, reported.

Filtrable viruses may be plastic and transparent forms of ordinary germs, rather than extremely small germs, Dr. Edward C. Rosenow of the Mayo Foundation suggested.

Bacteria were made to change to invisible form and back through regulation of the acidity of their food, Agnes Quirk, U. S. Department of Agriculture, reported.

A metamorphosis from round form to rod is a regular part of the life cycle of certain germs, Alice C. Evans, U. S. Public Health Service, found.

Vaccines made from bacteria blown to bits by sudden release of carbon dioxide previously squeezed into them under pressure, were reported by David Crowther of New York.

The virus of mosaic disease can be killed by pulverizing the plant it infests, it was indicated by the Rockefeller Institute for Medical Research.

A method for measuring invisible germs through the use of filter and centrifuge and a formula giving the correlation decrease of concentration and size of particles centrifuged was developed by Prof. H. Bechhold and Dr. M. Schlesinger, Frankfurt Institute for Colloid Research, Germany.

"Centrioles," minute structures of the male reproductive cells formerly considered mere distortions of other substance, are definitely existing objects with important functions, Dr. H. Herbert Johnson of the College of the City of New York reported.

New varieties of cotton plants were produced by X-raying seeds, by Prof. W. R. Horlacher, Agricultural and Mechanical College of Texas, and D. T. Killough, Texas Agricultural Experiment Station.

X-rays can reverse the direction of evolution, Dr. N. W. Rimofeeff-Ressovsky found in experiments with fruit flies at the Kaiser-Wilhelm Institute for Brain Research in Berlin.

Rate of growth is an hereditary trait, Dr. A. M. Banta, Carnegie Institution of Washington, found.

The diameter of the gene, unit of heredity, was reported by Prof. Oswald Blackwood, University of Pittsburgh, to be 80 Angstrom units or 32 hundred-millionth of an inch.

Genes, the ultimate units of heredity, were seen and photographed for the first time, by Dr. John Beling, Carnegie Institution of Washington.

The skeleton of an exceedingly primitive lemur was found in Germany by Prof. Johannes Weigelt, University of Halle.

The earliest known cat was among the fossils obtained from the Big Badlands of South Dakota for Princeton.

The Australian rat-kangaroo, believed extinct since 1843, was rediscovered by H. H. Finlayson of Adelaide University.

Riella, or "ruffle plant," one of the rarest species in the world, was rediscovered by Dr. R. A. Studhalter, Texas Technological College.

New plant varieties can be grown from sprouts off tumors, Dr. Dontcho Kostoff, Leningrad Academy of Sciences, and Dr. James Kendall, New York City College, found.

Cornstalks exclusively male, and others exclusively female, were bred by Prof. R. A. Emerson, Cornell University.

Parthenogenetic grasshoppers were produced at the University of Iowa by Eleanor H. Slifer and Dr. Robert L. King.

A female mule in South Africa, the property of W. J. Kilian, Weenan, Natal, was reported to have borne her second colt.

The python, though cold-blooded, becomes almost warm-blooded when incubating her eggs, found by Dr. Francis G. Benedict, director of the Nutrition Laboratory of the Carnegie Institution of Washington, Boston.

The brain can oxidize alcohol as well as lactic acid, Dr. L. H. Nahum, Yale University, reported.

Maternal tissues prepare for nourishment of the embryo before the egg is attached, Dr. George L. Streeter, Carnegie Institution of Washington, found from a study of monkeys.

An outbreak of foot and mouth disease occurred in southern California, but was suppressed.

A biological research station was established at Bermuda, made possible by the Rockefeller Foundation and the governments of Great Britain and Bermuda.

Chemistry

Coronene, a new hydrocarbon, was synthesized by Profs. Roland Scholl and Kurt Meyer, of the Dresden Technical University.

Lignin was made artificially in the U. S. Forest Products Laboratory by the heating of cellulose at 135 degrees Centigrade.

Knowledge of the composition of lignin, next to cellulose one of the most important constituents of wood, has been advanced by the distillation experiments of Max Phillips of the Color Laboratory, U. S. Department of Agriculture.

The neutron should be considered as a new chemical element of atomic number zero called "neuton," it was suggested by Dr. W. D. Harkins, University of Chicago.

The magneto-optic method used by Dr. Fred Allison, Alabama Polytechnic Institute, in the discovery of two new chemical elements, was reported by Drs. B. S. Hopkins and Gordon Hughes, University of Illinois, to be "one-thousand times more sensitive than the most delicate methods of analysis now used," but unreliable when used by untrained workers.

A new copper isotope of atomic weight less than 63 was found by the magneto-optic method by Prof. Edna R. Bishop, Alabama Experiment Station.

A chemical not yet isolated in crystalline form seems to make possible the growth of yeast, reported Dr. Roger J. Williams, University of Oregon.

Silica black, intensely black mixture of coal and silica, was produced by Prof. C. A. Jacobson, University of West Virginia.

Krypton was forced to combine with chlorine, in its first known chemical union, at the Chemical Institute at Bonn.

A chemical formula for growth-promoting vitamin A was found by Prof. Paul Karrer, Chemical Institute, University of Zürich, who showed it to be closely related to artificial violet perfume.

Growth-promoting vitamin A was isolated by Prof. J. C. Drummond, University of London, and associates, by splitting carotene.

Vitamin A was produced from carotene, yellow plant pigment, by ultra-violet irradiation, reported Drs. F. P. Bowden and C. P. Snow of Cambridge. This finding was disputed by Prof. I. M. Heilbron and Dr. R. A. Morton of the University of Liverpool, on the ground that action of ultraviolet light on carotene could only yield hydrocarbons, while vitamin A contains, in addition, oxygen in the form of an "alcohol" group.

Vitamin G consists of two different chemical factors working together, it was indicated by the research of Prof. H. C. Sherman of Columbia University, and Hazel Stiebeling, now at U. S. Bureau of Home Economics.

Isolation of the antineuretic vitamin B was reported by Prof. Adolf Windaus, University of Göttingen, Germany, who gave its formula as $C_{12}H_{17}N_3OS$.

Identity of newly-discovered hexuronic acid of adrenal gland origin and scurvy-preventing vitamin C was reported by Drs. J. L. Svirbely and H. Szent-Györgyi of University Szeged, Hungary, and Drs. C. G. King and W. A. Waugh of the University of Pittsburgh, who obtained the vitamin as crystals.

Drs. Otto Rygh, Aagot Rygh and Per Laland of Oslo, reported that vitamin C is derived from narcotine, non-narcotic poison of opium, but the English biochemist, Dr. Silsa, disputed this finding.

A color photographic process using two negatives exposed in conventional camera and two "gaslight" prints cemented together, was developed by Frederic E. Ives, of Philadelphia.

The National Research Laboratories were opened at Ottawa, Canada, with auditorium, exhibition halls and space for divisions of physics and engineering, chemistry, biology and agriculture, and research information.

The complete chemical structure of rotenone, one of the active principles of South American fish poisons, was discovered by F. B. La Forge, H. L. Haller and L. E. Smith, U. S. Department of Agriculture.

A method of electroplating with tungsten was patented by Dr. Colin G. Fink of Columbia University.

Two petroleum refining plants applying the hydrogenation process for the first time in this country were put in operation and licensing arrangements were made with fifteen refiners to use hydrogenation patents.

White paper was made experimentally from southern pine, now universally used to produce brown kraft paper.

A machine for making gas from anthracite was developed by the Anthracite Institute.

S-D-O, synthetic drying oil, relative of synthetic "rubber," constituent of acid- and water-resistant paints, was developed by E. I. duPont de Nemours & Company.

Cellulose has a molecular weight of 30,000, Prof. W. N. Haworth, Birmingham University, England, reported.

New rubber-like products were made from compounds similar to chloroprene by W. H. Carothers, of the duPont Laboratories, who had reported that he made from chloroprene an artificial rubber superior in many respects to the natural substance.

Medicine

A complex sugar contained in the cell capsule surrounding the pneumonia germ plays a leading part in the germ's disease-producing activities, research by Dr. Oswald T. Avery, Rockefeller Institute for Medical Research, indicated.

A toxoid injection which will build up resistance to scarlet fever, and also a concentrated and purified toxin for use in preparing the toxoid, were developed by the U. S. Public Health Service.

Immunity to yellow fever is made possible by a new method making use of mouse serum, reported Drs. T. P. Hughes and W. A. Sawyer, of the Rockefeller Foundation, New York City, who have also devised a test for the effectiveness of the protection.

A new pain-relieving drug five times as potent as morphine, but without the latter's habit-forming quality, was called to the attention of the medical profession by Dr. Walter C. Alvarez of the Mayo Clinic.

A second respiration ferment was found by Dr. Otto Warburg and Dr. Walter Christian of the Kaiser-Wilhelm Institute for Biology, Berlin.

Experimental evidence that virus diseases of plants and animals are caused by a non-living chemical substance analogous to enzymes, was reported by Dr. Carl G. Vinson of the University of Missouri.

Lead poisoning may be detected by X-rays of the bones, Dr. Edward C. Vogt of the Infants' and Children's Hospitals, Boston, reported.

One type of deafness known as otosclerosis was found to be inherited as a sex-linked characteristic, Dr. Charles B. Davenport, Carnegie Institution of Washington, Cold Spring Harbor, Long Island, reported.

A plug inserted in the round window in the middle ear increases the hearing considerably, Dr. Walter Hughson and Dr. S. J. Crowe, Otological Research Laboratory, Johns Hopkins, found in experiments with cats.

Satisfactory results from a new sex gland treatment for "bleeders," were reported by Dr. Carroll L. Birch of the University of Illinois College of Medicine.

The common cold lasts only three or four days and gives immunity for three months, longer illnesses being due to secondary infections, Dr. Wilson G. Smillie, Harvard, reported.

Treatment with bacteriophage can reduce the death rate from an ordinarily fatal type of blood-poisoning, it was reported by Dr. W. J. MacNeal and Dr. Frances C. Frisbee, New York Post-Graduate Medical School and Hospital.

Inhaling carbon dioxide relieves whooping cough, Prof. Yandell Henderson of Yale, reported.

X-rays owe their effectiveness in cancer treatment to a speeding up of the lives of the cells, Dr. Raphael Isaacs, University of Michigan, reported.

Vaccine promising to give immunity to endemic typhus fever was developed by Drs. R. E. Dyer, W. G. Workman, A. Rumreich and L. F. Badger, U. S. National Institute of Health.

That lack of phosphorus and vitamin D in the diet is the chief cause of dental decay was reported by Dr. R. Gordon Agnew of West China Union University, whose results bear out those reported last year by Dr. E. V. McCollum and associates of Johns Hopkins University.

A new method of diagnosing diseases of liver and spleen by injecting thorium dioxide, which gives clear X-ray pictures of these organs, was reported by Drs. Wallace M. Yater and Lawrence S. Otell, of Georgetown, University.

Faulty structure of the brain cells, which allows potassium to escape or other substances to enter when the body fluids are diluted by too much water, may be the cause of epilepsy, research of Dr. Irvine McQuarrie, University of Minnesota School of Medicine, indicated.

Sleep in man and hibernation in other animals are controlled by iodine compounds in the circulation, Dr. G. S. Carter, British scientist, reported.

Mucin was found helpful in the treatment of stomach ulcer by Dr. Arthur J. Atkinson, Northwestern University Medical School.

Ten-mile altitudes will not kill flyers if the nitrogen of their bodies is first expelled, Sir Leonard Hill, British physiologist, concluded from animal experiments.

Discovery in the kidney secretion of the expectant mother of a new hormone that shows sex of unborn child, was reported by Dr. John H. Dorn, University of California, and Edward I. Sugarman, Sugarman Laboratory, San Francisco.

Discovery that murrina, fatal horse disease, is transmitted by the vampire bat, marking third instance of a mammal being a disease vector, was reported by Dr. H. C. Clark, director of the Panama laboratories of the Gorgas Memorial Institute, where the discovery was made.

Discovery of a difference between cancer and normal cells, that when multiplication is prevented, the cancer cell alone fails to change structure, was reported by Dr. Z. Zakrzewski, Institute of Pathology, Kracow, Poland.

Cancer may be due to changes in the centrosomes, is the theory of Mrs. Margaret Reed Lewis and Dr. Warren H. Lewis, Carnegie Institution of Washington and Johns Hopkins.

A new male sex hormone which affects pituitary and adrenal glands, was reported by Dr. D. Roy McCullagh, Cleveland Clinic Foundation.

Infantile paralysis is contracted from a germ or virus entering through the membranes of the nose and passing along the nerves of smell to the brain and spinal cord, it was concluded by Dr. Simon Flexner, director of the Rockefeller Institute for Medical Research.

The infantile paralysis germ enters the nervous system directly through the nose, reported Dr. Harold K. Faber, of Stanford University Medical School.

Infantile paralysis occurs repeatedly in the same families, indicating a possibly hereditary factor, reported Dr. W. Lloyd Aycock of Boston.

The germ of typhus fever and of spotted fever, though much alike, grow in different parts of the cells they invade, Dr. Henry

Pinkerton of Peter Bent Brigham Hospital, Boston, and Dr. G. M. Hass of Children's Hospital, Boston, reported.

Successful treatment with X-rays of the usually fatal Hodgkin's disease was reported by Dr. A. U. Desjardins, of the Mayo Clinic.

Mosquitoes may carry tularemia, scientists of the U. S. Public Health Service found.

Dyes destroy the activity of the virus which produces a chicken tumor resembling cancer, reported Dr. Margaret Reed Lewis and Warren Reed Lewis, her son, Carnegie Institution Department of Embryology, Baltimore.

Ultraviolet radiation within the body was produced by injecting organic solutions excited by X-rays, reported Dr. Ellice McDonald and associates at the University of Pennsylvania.

An ionizing chamber, which may be used to measure dosage of radium actually reaching bodily organs, was reported by Dr. Louis Mallet, Tenon Hospital, Paris.

Prolactin, a third anterior-pituitary gland extract, was isolated and found to produce milk secretion even in male animals by a group at the department of genetics, Carnegie Institution of Washington.

Radiations from parts of the human body powerful enough to kill yeast, were reported by Prof. Otto Rahn, Cornell University.

Soricin, derived from castor oil, was found to make harmless the poison of snake venom as well as the intestinal toxins producing auto-intoxication, by Dr. Theodore H. Rider of the William S. Merrell Company.

Physics

The neutron, a combination of electron and proton having no electrical charge, was experimentally demonstrated by Prof. James Chadwick, of Cambridge, England.

Beryllium was bombarded with alpha particles (helium nuclei) by Prof. W. Bothe, German physicist, and a radiation obtained which was first thought to be super-gamma rays, but later thought to be neutrons given off with the formation of carbon 12.

Confirmation of the existence of the neutron was obtained through the bombardment of lithium with alpha particles, by Mme. Irene Curie-Joliot, and her husband, Dr. F. Joliot, at the Radium Institute, Paris.

The existence of a positive particle of matter having the mass of an electron was suggested by experiments of Dr. Carl D. Anderson, California Institute of Technology.

Radium disintegration is caused by the bursting of neutrons in unstable atomic nuclei made up entirely of protons and neutrons, according to a theory proposed by Prof. Werner Heisenberg, German physicist.

Oxygen was artificially disintegrated by bombardment with neutrons at the Cavendish Laboratory, Cambridge, England.

Cosmic rays may originate when magnetic poles combine to form the neutron, Dr. R. M. Langer, California Institute of Technology, theorized.

A mathematical explanation of the relative lack of intensity of cosmic rays near the equator through attraction of the particles toward the magnetic poles was offered by Prof. Georges Lemaitre, University of Louvain, and Dr. M. S. Vallarta of Massachusetts Institute of Technology.

Cosmic rays were found to increase in intensity at high altitudes, but decrease in penetrating ability, as a result of airplane flights by Dr. L. M. Mott-Smith, Rice Institute, in cooperation with the U. S. Air Corps.

A second ascent into the stratosphere was made by Prof. Auguste Piccard, who found no constant increase of cosmic radiation with altitude.

Argon gas under pressure increases the sensitivity of a cosmic ray ionization chamber, Drs. A. H. Compton and J. J. Hopfield, University of Chicago, found.

A sensitive automatic recording electroscope for cosmic rays which makes a permanent record, was developed by Dr. R. A. Millikan and Dr. H. Victor Neher, California Institute of Technology.

Liquid helium, the world's coldest liquid, was photographed for the first time by Prof. J. C. McLennan and associates of the University of Toronto.

A new low temperature of minus 272.3 degrees Centigrade was attained by Prof. W. H. Keesom, Leiden University, by producing a high vacuum over constantly stirred liquid helium.

A new low temperature laboratory was built at the California Institute of Technology.

A vacuum tube sensitive enough to respond to an electric current of one quintillionth of an ampere was constructed by the General Electric Company.

Dr. Albert Einstein, influenced by evidence of receding nebulae accumulated at Mt. Wilson Observatory, jointly with the Dutch astronomer, Prof. Willem de Sitter, revised the theory of curved space and suggested that space may be the sort of uncurved, three dimension space that Euclid imagined.

Dr. Albert Einstein extended his unification of the laws of gravitation and electricity to the interior of the electrons and protons.

That one magnetic pole can exist apart from another of opposite sign, was suggested by the British physicist, Dr. P. A. M. Dirac.

Velocity of light does not decrease with passage of time, independent experiments of Dr. Olin C. Wilson, Mt. Wilson Observatory, and Prof. Roy J. Kennedy, at the California Institute of Technology, indicate.

Discovery of three kinds of tides in the atmosphere, caused by gravitational forces of the sun and moon and daily heating and cooling of the air, was announced by Prof. J. Bartels, German research associate of the Carnegie Institution of Washington.

A super-centrifuge microscope in which cells and other objects may be observed whirling at bullet-like speeds, was developed through the cooperation of Prof. E. Newton Harvey, Princeton, co-inventor of the centrifuge microscope, and Dr. J. W. Beams and A. J. Weed, University of Virginia, inventors of the super-centrifuge.

A stroboscopic camera making exposures in 1/100,000 second was developed at Massachusetts Institute of Technology.

A new dye for sensitizing photographic plates, zenocyanine, for photography by infra-red light from 8,000 to beyond 11,000 Angstrom units, was developed at the Eastman Kodak Laboratories.

Artificial aurora was produced by Dr. Alexandre Dauvillier, of Paris, by bending slow electrons in an evacuated bulb.

A gravity balance so delicate that it detects the moon's attraction was invented by Dr. Kenneth Hartley, Houston, Texas.

Surely the foregoing record of the progress of science in 1932 is proof ample of the fact that depressions come and depressions go—but man's search for truth goes on forever.

IVOR GRIFFITH.

SELECTED EDITORIAL

THE CHEMICAL NATURE OF ENZYMES.*

A CENTURY has passed since Payen and Persoz, in 1832, prepared from malted barley an extract that converted starch into sugar somewhat as strong acids do. This conversion was carried out even though living cells were not present. The effective agent was designated diastase—an expression until recently applied by French writers to all enzymes. Later came the discovery of the proteolytic agent pepsin, in the gastric juice, explaining how meat could be digested in glass vessels as it is in the living stomach. Presently it became customary to distinguish between the organized ferments, that is to say, living organisms such as yeasts and bacteria, and the so-called unorganized ferments. The latter were evidently chemical substances that are the products of living cells. Forty years ago a writer [1] described them as remarkable substances invested with the power of producing molecular rearrangements in products with which they come in contact. In harmony with the chemists of his generation he attributed a protein nature to the active agents; at any rate, they seemed always to be associated with proteins. The adoption of the designation "enzyme" for the unorganized ferments or diastases of old did not alter the uncertainty that attended the consideration of their nature and function.

Since Buchner's clear-cut demonstration, in 1897, that enzymes can unquestionably exert their potencies without the intervention of living organisms, it has become more probable that they function as biochemical catalysts. Thus, one finds enzymes defined in modern textbooks [2] as catalysts produced by living cells but whose action is independent of the living cells that produce them. The physician has long been familiar with some of the enzymes. The words diastase, ptyalin, pepsin, trypsin and erepsin are of frequent occurrence in medical literature, and they have been supplemented by many more representing each newly discovered specific biochemical

*Reprinted from the *Journal of the American Medical Association*, Jan. 7, 1933, p. 44.

[1] Halliburton, W. D.: *Textbook of Chemical Physiology and Pathology*, London, Longmans, Green & Co., 1891.

[2] For example, Cameron, A. T.: *Textbook of Biochemistry*, ed. 3, New York, Macmillan Company, 1931.

catalyst. The phosphatases of blood and bone are at present receiving special consideration in relation to the development of osseous structures and the healing of injuries to these.

Waldschmidt-Leitz [3] has recently pointed out that the modern development of enzyme research is directed above all to two particular lines of inquiry: the question of the chemical nature of enzymes and the question of the character and cause of their peculiar mode of action—their specificity. The problems have been somewhat simplified by the successful crystallization of a number of enzymes, including urease, pepsin, trypsin and amylase. All these purified compounds have seemed to their discoverers to be of protein nature. This has been denied by more than one recent investigator; hence one may read about protein-free pepsin. The assumption is that the protein heretofore assumed to be present is merely a contaminant of the actual enzyme. Studies by Tauber [4] leave little doubt, however, that even the purest enzmyes are protein in character. It happens, as he has observed, that very dilute active enzyme solutions may easily escape the usual protein tests and thus lead to the erroneous interpretation that enzymes are non-protein substances. There seems, nevertheless, to be no occasion to abandon the current belief in the protein nature of enzymes. Catalytic potency and protein properties are attributes of the same molecules.

Bacteriophage Versus Germs—The exact process by which bacteriophage destroys bacteria or germs was described by Professor J. Bronfenbrenner of Washington University Medical School at the meeting of the Society of American Bacteriologists. Watching the bacteria under the microscope, he saw that under the influence of the bacteriophage they swell, burst and disappear.

Further investigation showed that the swelling is the result of imbibing water. This in turn results from digestion within the cell of part of the cell protoplasm and consequent increase of osmotic pressure within the cells.

Before the swelling starts, however, and very soon after the bacteriophage is added, the rate of growth of the bacteria is greatly increased. This acceleration of the processes of growth and digestion is the primary effect of the bacteriophage, Professor Bronfenbrenner concluded. The consequent imbibition of water, swelling, bursting and disappearance of the germs are secondary effects.

ORIGINAL ARTICLES

VITAMINS

By Horatio C. Wood, Jr.

LOUIS IX, if not the wisest king that France ever had, was certainly the most religious. For his piety he was canonized and he is popularly known as St. Louis. Becoming convinced that it was his duty to recapture from the Moslems the sacred places of Palestine which had been lost to Christendom since the Crusades, he conducted several campaigns against the Saracens. One of these invasions in the year of 1260 was wrecked by a strange plague that visited his troops, and of which he himself nearly died. Some attributed this epidemic to the effects of climate, others regarded it as a punishment for the sins of the soldiers, but the description left by De Joinville, one of his officers, leaves no room for doubt that it was an outbreak of what we now call scurvy.

Horatio C. Wood, Jr.

In the fifteenth century a wave of exploratory fever swept the world and long sea voyages became the rage among mariners, and scurvy, which had been, since the time of Louis, a recognized if not frequent disorder, achieved great economic importance. Vasco Da Gama, who was the first to reach India by circumnavigating Africa, lost 100 out of a crew of 160 through this disease. Jacques Cartier, the discoverer of Canada, in the journal of his second voyage of 1535, writes "With such infection did the sickness spread in our three ships that about the middle of February of 110 persons that we were, there were not ten whole, eight were already dead and more than fifty sick past all hope of recovery. By the middle of March, twenty-five of our best men had died and all the rest were ill, when it pleased God to cast his pitiful eye on us and send us knowledge of a remedy for our health and recovery." The remedy which the "pitiful God" revealed to them, through the instrumentality of the American savages, was a decoction made from the bark and leaves of a tree growing in the Gaspé Peninsula and called by the

natives "Amenda." Sir Richard Hawkins, who was one of the captains under the notorious Drake and rose to be vice-admiral of the British Navy in the beginning of the seventeenth century, asserted that he knew of 10,000 deaths from scurvy among seamen. It has been estimated that during the seventeenth century more sailors died from scurvy than of all other causes combined.

The disease, however, was not limited to those who sailed the seas. The early efforts at colonizing Canada were thwarted by this same plague, and within the memory of living men and in this fair land of ours it has caused a serious amount of illness. In the five years of our Civil War, 30,714 cases of scurvy were reported among the white troops.

It has long been surmised that scurvy is caused by the lack of fresh vegetables and has been known for centuries that lemons and oranges are a sovereign remedy. Dr. Ronsseus, in 1564, remarked that seamen on long voyages cure themselves with oranges and conjectured that the discovery of this remedy was probably made accidently by Dutch sailors returning from Spain with a cargo of this fruit. But why fresh vegetables prevent scurvy, or what it is in lemon juice that cures the disease, these ancients had no idea, and neither have we. In order to talk about it we give it a name, vitamin C, but of what is its true nature, we are as ignorant as they.

In all this marine holocaust the voyage of the famous Captain Cook, explorer of Australia and the South Sea Islands, stands out as a beacon light. For three years he sailed the southern seas, cruising more than 60,000 miles, and among his crew of 118 men there was not a single case of scurvy. He, himself, attributed this marvelous result, and historians are inclined to agree with him, to the use of a brew which he called "sweet wort" made by infusing germinated barley. Incidentally, he made a great discovery which having been forgotten for 150 years, is now rediscovered by our great scientists, namely, that seeds which have no curative or preventative value against scurvy acquire these properties during germination.

Another ancient plague, although one which was not so important in Europe as in Asia, is the condition known as beri-beri. Accurate descriptions of this disease by Chinese writers date as far back as the sixth century. In the war against Russia in 1904 more than 50,000 Japanese soldiers were sick-listed home on account of beri-beri. There have been occasional outbreaks of small proportions in some of the isolated sections of Canada and the United

States. As recently as 1907 in Vol. 3 of Osler's "Modern Medicine" the author of the article on beri-beri wrote "While diet and particularly a more exclusive rice diet may act as a predisposing factor, it cannot be a determining and final factor."

In 1897 a Dutch physician named Eijkman, who was a medical officer for a prison in Java in which there were a large number of cases of beri-beri, noticed that the chickens which fed on the scraps from the table acquired a disease strikingly similar to that of beri-beri. Inspired by this observation, he was led to experiment with the diet of the prisoners, and after some study became convinced that the disease occurred only among those who lived on polished rice. He divided the prisoners into two groups; to one group he fed natural rice and to the other milled, or polished, grain. Among the latter group there was 70 per cent. affliction with beri-beri, while among those who ate the unpolished rice there was only one case. Subsequently it was shown that the polishings from the rice would cure the disorder. The substance which prevents beri-beri we also call a vitamin, but do not know what it is.

Some twenty years ago a couple of American physiologists, Osborne and Mendel, reported that rats which had been nourished on a highly purified diet became afflicted with a peculiar disease of the eyes, which was rapidly cured when a small amount of butter was added to their food supply. In 1917 a Danish physician, named Bloch, described an outbreak of cases of a similar affection of the eyes occurring among the babies in a hospital in Copenhagen. He saw the similarity between the diseases of the babies and of the rats and the condition was soon recognized as due to the same deficiency in the diet.

And where did we get this word which stands for an idea, the meaning of which is so incomprehensible? In 1912 Casimir Funk thought he had isolated the substance present in rice polishings which cures beri-beri and applied to it the word "vitamin." This word has now come to signify an idea rather than a substance and is applied to all that group of foodstuffs which prevent what are now known as deficiency diseases.

Within the last fifteen years these deficiency diseases have been the subject of a tremendous amount of scientific experiment. We call them deficiency diseases because they result from a diet which is lacking in some special factor. As an outcome of the industry of a group of biological chemists, who have devoted a large part of their energies to the study of this subject, we recognize today six

distinct disorders arising from this type of dietetic deficiency. We can express this statement in more popular, if less accurate, language by saying that six different vitamins are generally recognized. This popular statement is somewhat inaccurate because only two of these vitamins have ever been seen and how can we recognize what we have never seen? It is highly improbable that these six vitamins complete the list of this type of essential accessory foods, but so far they are the only ones whose existence can be regarded as definitely established.

Knowing nothing of the chemical nature of these food elements, surmising their existence only from circumstantial evidence, the investigators in this field used the letters of the alphabet to distinguish between the different vitamins. The time is, however, probably not far distant when we shall be able to give each of these specific elements a real name instead of an initial. We know very little about the role of these vitamins in the bodily chemistry; that is, why they are necessary or how they act. All that we know is that certain definite symptoms are produced when there is a deficiency of one or the other of these elements. In our review of present-day knowledge, or should we say theories, we must remember that most of our conclusions are based upon experiments made on rats, or chickens, or guinea pigs, and there is reason to suspect, at least, that different kinds of animals react in different ways to the absence of a certain vitamin.

In studying vitamin deficiencies we must distinguish between the symptoms produced by a complete or prolonged lack of one of these elements and the disturbances which result from a slightly insufficient, or suboptimal, supply.

Let us take up these so-called deficiency diseases in the alphabetic order of their protective vitamins.

Vitamin A, which is closely related to, if not identical with, the vegetable coloring matter known as carotene,* is found in most of the yellow colored vegetables such as carrots, sweet potatoes and pumpkins. Carotene is also one of the components of chlorophyl, the green coloring matter of leaves, and is therefore found in spinach, green peas, broccoli and other leafy foods. It may be noted that bleached leaves, such as white celery and light-colored lettuce, contain only very small amounts. It occurs also in certain fruits

*The most recent studies of carotene indicate that it is a precursor of vitamin A and is changed into the physiologically active substance by the effect of ultraviolet light.

such as tomatoes, apricots, bananas and peaches. Butter, which was formerly regarded as the great natural source of this vitamin, varies considerable in its richness. When the cows are fed with a green diet, such as summer pasture, their milk, and consequently the butter obtained from it, will be rich in this vitamin. In winter time if the food does not contain green leaves the butter will often be of a very pale color indicating a deficiency of carotene. For years the public has instinctively preferred, without knowing why, a brightly colored butter. Dairymen, desirous of gratifying this instinct, are in the custom of adding artificial coloring matter to the winter butter. If a coal-tar dye is employed—as it frequently is—then the yellowness of the butter affords no criterion of its value.

It has been found that about 0.004 of a mgm. of carotene is sufficient to cure the results of vitamin A deficiency in young rats. If human beings require proportionately the same amount of carotene as rats, it would take about 8 mgm., or one-eighth of a grain, daily to restore health to a full-grown adult.

When the supply of carotene begins to fall below the necessary amount the earliest symptoms observed in young animals are a cessation of growth and increased susceptibility to infections, especially of the respiratory tract. If this food element be completely absent they begin to develop ocular disturbances and lack of sensitiveness of the retina—so that they have difficulty in seeing in dim light—and then an inflammation (technically known as Xerophthalmia) around the eyes which is apparently due to the drying up of the tear secretion. If not corrected this may lead to total blindness. As mentioned above this same condition of the eyes has been noted in children who were fed with oleomargarine in the place of butter.

Beri-beri. The chemical nature of vitamin B is not definitely known but there is considerable evidence that it is a nitrogenous organic base. The first evidence of its lack is a disturbance of the appetite which is apparently due to a diminution of the digestive powers of the stomach. This would naturally lead to a loss of weight and strength. If the deficiency be serious there develops an inflammation of the nerves all over the body causing paralysis of the muscles and disturbances of sensation. Later, there frequently develops weakness of the heart, associated with shortness of breath and dropsical conditions of the legs. This is the disease known as beri-beri.

Vitamin B is found in the seed covering of grains and probably all other seeds. It is therefore abundant in unmilled cereals—as

unpolished rice or whole wheat—and in peas and beans. It is found also in many other foods including especially eggs, cabbage, celery, lettuce, potatoes, spinach, fish roe, liver, cheese, apples, oranges, strawberries, nuts, etc. The commercial producers of yeast lay considerable stress on the richness of this substance in vitamin B. It is true that yeast generally contains large proportions of it, but Eijkman, the discoverer of vitamin B, insists that the growing yeast does not produce the vitamin but simply appropriates it from the material in which it is cultivated. Other investigators, however, do not agree with this conclusion.

Vitamin C. While scurvy is rarely seen today among the adult population, a mild form of the disease is not uncommon in infants.

One of the earliest symptoms is pain in the muscles of the limbs which is often diagnosed as rheumatism. There is often also swelling around the ankles, sometimes other joints. The gums become swollen and inflamed and bleed easily. One of the characteristic signs of fully developed scurvy is the tendency to hemorrhages in all parts of the body on the least provocation, or on no provocation. In infants there usually is a retardation of growth or at least a failure to gain in weight. A very early symptom of deficiency of vitamin C, at least in guinea pigs, and presumably in human beings, is a degeneration of the nerve cells and blood vessels of the teeth which lead to an increased likelihood of decay and imperfectly formed teeth.

Vitamin C, which prevents scurvy, is one of the most widespread of this group. While it is found only in small quantities in meat, it is abundant in many of our common vegetable foods. The richest sources are raw cabbage, tomatoes, lemons, oranges, but it is also found in useful amounts in lettuce, onions, peaches, rhubarb, strawberries, spinach, potatoes, peas, etc.

Of all the vitamins the antiscorbutic vitamin is one of the least stable. Cabbage boiled for twenty minutes loses 70 per cent. of its antiscorbutic property, long cooking completely destroys it. Even drying at low temperature destroys practically all of the vitamin C. This fact was well known 200 years ago but has been repeatedly forgotten. Desiccated vegetables were used during the Civil War with no apparent influence on the occurrence of scurvy, and laboratory experiments with various commercially dried vegetables show that they have lost most of their vitamin C. Recent studies, however, have demonstrated that it is possible under certain conditions to either heat or dehydrate vegetables without destroying their pro-

tective value against scurvy. In fact some commercially canned fruits—as pineapple and tomato—are still usefully potent.

An interesting observation is that apparently the vitamin C in one vegetable may be devitamized by heat while another is markedly resistant. Thus dandelion greens, like cabbage, are very sensitive to heat, while canned tomatoes, which have been exposed to more severe temperatures than ordinary cooking, still retain much of their vitamin C. It is not the acid alone which protects the vitamin against the heat for lime juice, which is just as acid as lemon juice, is much more easily affected.

Apparently there is no provision in the economy for storage of vitamin C. Dr. Hess took two groups of guinea pigs, one of which he fed on a diet with a minimal amount of vitamin C and the other with a very free supply and at the end of a period of two weeks put both groups on a diet completely lacking in this vitamin; the two groups developed scurvy almost at the same time.

To keep in good health a man needs an almost continuous fresh supply of vitamin C. The five richest sources of this vitamin are juices of lemons, oranges, grapefruit and tomatoes and raw cabbage. It is, however, also found in notable amount in many fresh foods, including lettuce, raspberries, onions, peaches, pineapples, spinach, watercress, etc.

Although milk may contain a sufficient amount of this vitamin to protect infants when fed on an exclusive milk diet, it cannot be relied upon because the proportion of vitamin C varies greatly with the diet of the cow.

A very interesting fact known to Captain Cook 150 years ago, which has been confirmed by modern scientists, is that seeds like barley, wheat, peas and beans, which contain almost no vitamin C, if allowed to sprout, develop this protective factor.

Rickets. Of all vitamins, probably none has been so widely advertised and consequently such a popular subject of discussion as the antirachitic, that is rickets curing factor. This material, commonly known as vitamin D, has been prepared in a chemically pure form and namel calciferol. In contrast to the other vitamins, nearly all of which are of vegetable origin, this substance is found almost exclusively in the animal kingdom. Naturally so since its chief function is associated with the utilization of lime salts—which are the stiffeners of our bones—and lime is a comparatively unimportant element in vegetable metabolism. Few of our common foods contain it in useful amounts. It is found richly in the yolk of eggs, in

the liver of various animals, and to some extent in oysters and clams. The proportion which is found in dairy products such as milk and butter will depend upon the conditions under which the cows have been kept. Fortunately man is able to manufacture his own calciferol provided he can have a little sunshine.

The sterols are a group of compounds related to some of the fatty acids. The chemists define them as monohydric alcohols of the higher fatty acids, among these is a substance known as ergosterol, so called from the fact that it was first obtained from ergot. Heat, light and x-rays are commonly regarded as being vibrations of different lengths. Certain of these waves which are near the limit of those visible to our eyes called the violet and ultra-violet rays affect ergosterol, changing its chemical composition, and producing the substance which has been named as calciferol. The separation of this substance was accomplished by a group of chemists working under the leadership of Dr. Bourdellon. It is so potent that 1/24,000 of a grain daily would be enough to cure a case of rickets in a child seven years old.

Of vitamin E we know relatively little. Its absence does not appear to materially effect any of the organs of the body except those concerned in reproduction. It apparently is found in meat and in the cereals, lettuce, peas and some other foods.

Pellagra. This disease known as pellagra is characterized by three essential symptoms, namely: inflammation of the skin, diarrhea and mental disturbances. It has occurred more or less epidemically in the southern United States and in southern temperate climates in other parts of the world. The cause of this condition has been the subject of much difference of opinion and cannot even now be considered as definitely settled. Most authorities, however, consider today that an important factor in the causation of this disease is the absence of a protective element from the diet. This is generally known in this country as vitamin G, but is sometimes spoken of as vitamin B2 or as PP factor (Pellagra Protective). It is found in meat, liver, potatoes, spinach, eggs, milk, bananas, tomatoes and many other foods.

When one contemplates the many horrible things which happen to a man who does not eat his vitamins he begins to wonder how it is that the human race has survived for these 100,000 years or more in complete ignorance that such things existed. Anthropologists tell us that there have been in the past various species of the genus homo, such as the Java man, the Pekin man and the Piltdown man.

Of all these species only homo sapiens survives. We often wonder why human beings are called wise. Perhaps the reason of their survival is because they were sapient enough to know vitamins without seeing them. The fact that we are living today is proof that our fathers ate vitamins and that if we eat the same things that our forefathers did we shall continue. The human race will survive without the aid of yeast, irradiated bread and vitaminized tooth paste as long as it continues the dietetic habits which through eons of evolutions have made it what it is. While it is true that in the course of the centuries many individuals have been crippled or killed by vitamin starvation, after all the number of these are insufficient in comparison with the great host of men and women who have fulfilled their alloted span of life in blissful ignorance of deficiency diseases.

The reason that the race has survived in the past is because men have steered clear of the food faddists or have been driven by necessity to eat a large variety of foods. Man is obviously constructed to be an omnivorous animal. He has neither the teeth nor the digestive organs to live on grass alone. He had not the offensive teeth and claws for a beast of prey.

His diet has been a rich mixture of all sorts of animal and vegetable materials. As long as he continues to eat such a variety of foods he need not worry about deficiency diseases. Let me offer to you two menus, both containing all the essential vitamins and ask you which appeals to your appetite the more:

Menu No. 1.

Raw oysters (D).
Fried liver (B, E and G).
Sweet potatoes (A).
Fresh peas (A, B, C and E).
Tomato salad (A, B, C and G).
Strawberries with cream (B and D).

Menu No. 2.

Grapefruit cocktail (B and G).
Yeast sandwiches with radiated bread (B, D and G).
Boiled cabbage (A, B and C).
Alfalfa salad with codliver oil dressing (A, E and D).
Sliced bananas (A, B, C and G) with molasses (E).

One more problem which I should like to discuss and that is as to the effect of excessive amount of these food elements. The opposite of heat is cold; the opposite of sickness is health. It is natural instinct of the human mind to think that if a little money makes us happy more money will make us more happy; that as a modicum of labor is requisite for contentment or existence, the more we work the better off we are. All of these deductions, logical though they may sound, are obviously untrue. It is as bad to be too cold as too hot. Great wealth does not bring happiness and the man who works too hard breaks down his health. A certain amount of food is necessary for life, but it does not follow that an excess of food is beneficial.

For example, let us concede that the lack of vitamin B leads to a loss of appetite. No one claims that it is the only cause for this. Suppose that the failure of the desire of nourishment is due to emotional disturbance or disorder of digestion or any of the numerous other factors inducing this symptom can we hope to relieve it by piling in unlimited quantities of vitamin B? I do not think so—or again granted that the lack of carotene and calciferol stunts the growth of young animals—there is no evidence that we could develop a race of giants by feeding inordinate quantities of these vitamins.

If a person is abnormally susceptible to colds it is well to inquire into their dietetic habits and to be sure that they are receiving an adequate supply of vitamin A, but we need not hope that the use of this vitamin alone can abolish the danger of catching cold. Sore throat is one of the characteristic symptoms of diphtheria but we do not inject antitoxin into every patient who has a sore throat.

The fact that rickets develops from lack of vitamin D is no reason why a rational being should make the procurement of this element the major interest of his life. There is no reason to suspect that an excess of calciferol is beneficial and there is much evidence that inordinate quantities of it may be almost as injurious as its absence.

While I am strongly convinced that the person who eats a reasonably large variety of foods is reasonably sure of obtaining a sufficient supply of vitamins, it must be confessed that there are some individuals who have allowed the whims of the palate to usurp the place of our natural dietetic instincts. For such, who have to consciously, and conscientiously, search for vitamins I have pre-

pared a list of foods commonly appearing on our tables, which are especially valuable for their vitamin content.

Some Important Sources of Vitamins

Explanations:

1 means small but useful amount of vitamin.
2 means excellent source of vitamin.
3 means exceptionally rich in vitamin.
0 means not enough to be of service.
— means probably absent.

	A	B	C	D	G
Milk	2	1	1	1	2
Butter	2	0	0	1	—
Eggs	2	2	0	2	2
Spinach	2	1	1*	—	2
Cabbage	1	2	3*	—	1
Tomato	2	1	3	—	1
Lettuce	2	1	2	—	1
Peas	1	2	2	—	—
Orange	1	1	3	—	—
Banana	1	1	1	—	1
Pineapple	2	2	2	—	—
Peach	2	1	2	—	—
Carrot	2	1	1	—	1
Onion	—	1	3	—	1
White potato	0	1	1	—	2
Sweet potato	2	1	0	—	—
Whole wheat	0	2	0	—	1
White bread	0	1	0	—	0
Yellow corn	1	2	1	—	0
Beef	—	—	—	1	2
Liver	1	1	1	1	3
Salmon	0	1	0	2	2
Oyster	1	1	—	1	—

*The amount of vitamin C in these vegetables depends upon whether they are taken raw or cooked. Much of this vitamin is destroyed by heat.

A TEST FOR PHENOLS AND FOR COPPER

By Charles C. Fulton

Associate Chemist, U. S. Industrial Alcohol Bureau, Minneapolis, Minn.

DESCRIPTIONS of the Deniges-Oliver test for morphine seem always to state, or at least assume, that the test is peculiar to morphine and a few of its derivatives. As a matter of fact this test is a general one for phenols. However, many phenols give the test best in alcoholic solution, although some resemble morphine in reacting best in aqueous solution.

The test for morphine is performed as follows:

Dissolve a little morphine in dilute acid, or a morphine salt in water. To some of the solution in the spot of a spot-plate add 2 or 3 drops of hydrogen peroxide (the ordinary 3 per cent. solution), and a drop or two of ammonia. Stir the solution with a piece of copper —a copper wire or a penny. Bubbles of oxygen are given off as the peroxide decomposes, and a pink to red color quickly develops. The test is sensitive to about 1 part of morphine in 3000 of solution. The copper dissolves gradually in the ammoniacal solution, and with continued stirring, and in the absence of any phenol or other reactive compound, the solution gradually becomes blue. Dilute copper sulfate solution can be added instead of stirring with copper.

As a general test for a phenol, dissolve the substance to be tested in 5 or 6 drops of alcohol, on the spot-plate; add 3 drops of hydrogen peroxide solution, 2 drops of ammonium hydroxide solution (about 5 N, or 1 + 2), and stir with a piece of copper.

In such a test the great majority of phenols give a pink, red, purplish-pink, or salmon-pink color, often changing soon to yellow or brown. Phenolic compounds giving particularly good reactions of this kind include morphine; heroine; carbolic acid; ortho-, meta-, and para-cresol; para-cresol acetate; ortho-, meta-, and para-chlorophenol; 4-hydroxy 1, 2-dimethyl benzene; 4-hydroxy 1, 3-dimethyl benzene; salicylic acid; aspirin; meta-hydroxy-benzoic acid; guiacol carbonate; thymol; carvacrol; diathesin, and resorcin.

Para-hydroxy-benzoic acid, vanillic acid, pseudomorphine, anisole, and anethole also react, and although the test is less sensitive to them the first two at least are much better tested this way than by the alternative test tube procedure given below.

The pink or red compound formed is always rather unstable. It is always quickly destroyed by too much copper.

It is generally assumed that the action of the copper is "catalytic." It is more probable however that a phenol-copper compound is formed, and that the red color produced is primarily due to the copper rather than the phenol. Of course the copper catalytically decomposes the hydrogen peroxide, thus providing the oxidizing power under which the reaction takes place; but salts of other metals which catalytically decompose hydrogen peroxide do not, as a rule, give any noticeable phenol reaction. As an exception, manganese does give a reaction similar to that of copper with aspirin or salicylic acid.

Acetyl derivatives of phenols, as for instance heroine, para-cresol acetate, and aspirin, give the reaction as readily as true phenols. Methyl derivatives of phenols, as for instance codeine, do not react.

Diphenols are very susceptible to simple oxidation, usually yielding a red or brown color. Copper, manganese, cobalt, and other substances promoting the decomposition of hydrogen peroxide may cause this simple oxidation. Resorcin in minute amount gives the copper test like monophenols; with a larger quantity simple oxidation to a brown-colored compound takes place.

Alpha and beta naphthol give a characteristic reaction unlike that of other phenols, a green color being produced. With them, copper causes the reaction, but the peroxide is not necessary.

As another method of performing the test, treat the phenol in a test tube with 3 cc. water, or with 5 cc. alcohol, or with 1 cc. alcohol and 2 cc. water. Add 0.5 cc. hydrogen peroxide solution and 0.5 cc. ammonium hydroxide solution. Then add copper sulfate solution, containing about 1 part copper per 1000 parts of solution, a drop at a time, with shaking.

Phenols that develop the pink or red color best in water include morphine, heroine, pseudomorphine, aspirin, meta-hydroxy-benzoic acid, para-creosol acetate, and perhaps salicylic acid, for which there is not much choice.

Those that react best in alcohol include carbolic acid, resorcin, veratrole, arbutin, vanillyl alcohol, diathesin, and anisole.

Those that react best in dilute alcohol include thymol, carvacrol, anethole, ortho-, meta-, and para-cresol, tri-cresol, 4-hydroxy 1, 2-dimethyl benzene, and 4-hydroxy 1, 3-dimethyl benzene.

There is not much choice for ortho-, meta-, or para-chlorophenol, or eugenol; it will perhaps be best to use dilute alcohol for them.

The following phenolic compounds seem to give only yellow or brown colors, not developing the characteristic pink or red in any form of the test; tyrosine, zinc phenyl sulfonate, beta oxynaphthoic acid, para-hydroxy-benzaldehyde, vanillin, tanic acid, amyl salicylate, 2-hydroxy 1, 3-dimethyl benzene, sulfosalicylic acid, iso-eugenol, and benzyl-isoeugenol.

With some of the phenols a 1:100 copper solution may be used to advantage, provided one drop only is added until its effect is clearly seen. This stronger copper solution is almost necessary with eugenol; on the other hand a 1:100 solution is much too strong to use with morphine and some others, with which a 1:10,000 solution can be used. A 1:1000 copper solution is nearly always satisfactory.

. . . . . .

Several of the phenols are extremely sensitive to copper and can be used to detect that element. Tests on alloys, or even ores, can be made by using morphine, or some other sensitive phenol, as in the spot-plate test, and stirring with a piece of the substance under examination.

Tests for copper in aqueous solution may be made as follows:

The phenol is dissolved in water or alcohol as specified, 0.5 cc. each of hydrogen peroxide (3%) and ammonia (5 N) are added, and 5 cc. the solution to be tested.

Morphine shows unmistakably 1 part of copper per 3,000,000 of the solution tested; while thymol, 4-hydroxy 1, 2-dimethyl benzene, and resorcin each detects about 1 part in 1,000,000. The reactions of these substances follow:

Parts copper in solution tested.	*Morphine sulfate,* about 0.03 gm., dissolved in *1 cc. water,* and treated as above.
None	colorless; slight yellowish tint after 15 minutes.
1/6,000,000	slight orangish tint in 5 minutes; salmon tint after 15 minutes.
1/3,000,000	distinct salmon tint within 5 minutes.
1/1,000,000	light salmon-pink within 2 minutes; light salmon in 15 minutes.
1/300,000	pink almost immediately; salmon color after 10 minutes.

1/100,000	pink at once, soon red-pink; salmon color after 10 minutes.
1/30,000	pink at once, changing to bright red within 5 minutes.
1/10,000	pink-red, soon bright red.
1/5,000	(too strong a copper solution)—pink-red with the first few drops, quickly decolorized with excess copper; brownish orange color with 5 cc., becoming fairly strong brown-orange.

Parts copper in solution tested.	*Thymol,* about 0.03 gm., dissolved in *1.5 cc. alcohol,* and treated as above.
None	no effect.
1/3,000,000	no effect.
1/1,000,000	slight purplish-pink tint develops in 10 to 15 minutes.
1/300,000	light pink within 1 minute, changing to purple.
1/100,000	purplish-pink within 45 seconds, changing to purple.
1/30,000	light purple-pink within 30 seconds, becoming purple, then changing to brown within 5 minutes.
1/10,000	yellow, changing to purple within 15 seconds; dark brown within 2 minutes.
1/5,000	yellow with the first few drops; dark brown with 5cc.

Parts copper in solution tested.	*4-hydroxy, 1, 2-dimethyl benzene,* 0.03 to 0.04 gm., dissolved in *1 cc. alcohol,* and treated as above.
None	no effect.
1/6,000,000	no effect.
1/3,000,000	yellowish tint after 15 minutes.
1/1,000,000	slight salmon tint after 12 or 15 minutes; distinct salmon within 1 hour.
1/300,000	yellowish within 1 minute; pale salmon in 12 minutes; salmon-orange in 1 hour.
1/100,000	salmon-pink within 1 minute, good pink within 3 minutes; salmon-orange in 1 hour.
1/30,000	pink almost at once; salmon-pink in 5 minutes; orange in 1 hour.
1/10,000	yellowish, changing to pink at once; salmon-pink in 1 minute; cloudy brown in 1 hour.
1/5,000	yellow changing to pink, changing to brown as the test solution is added; quickly dark brown.

Parts copper in solution tested.	*Resorcin,* about 0.005 gm., dissolved in *5 cc. alcohol,* and treated as above. A very small quantity of resorcin is used to minimize the effect of simple oxidation. Only the immediate pink or red color is especially characteristic of copper; the brown may result from another metal catalyzing the decomposition of hydrogen peroxide.
None	yellowish.
1/3,000,000	yellowish, perhaps with a faint pink tint; weak brown within 15 minutes.
1/1,000,000	pink tint—good pink, looking down tube—changing to brown in about 2 minutes.
1/300,000	good pink; changing to brown in 1 minute.
1/100,000	strong red-pink; soon changing to dark brown.
1/30,000	strong red, quickly changing to dark-brownish red; dark-reddish brown in 7 minutes.
1/10,000	strong red, changing to dark red; dark-reddish brown in 5 minutes.
1/5,000	strong dark red, changing to dark brown within 2 minutes.

Summary

The Deniges-Oliver test, or Copper test, stands in the texts as peculiarly characteristic of morphine and certain of its derivatives, such as heroine. As a matter of fact it is a general test for phenols and their acetyl derivatives, although many phenols have to be tested in alcoholic solution rather than aqueous. Directions are given for making the test a general one for phenols, and a considerable number of phenols are listed that give reactions closely resembling that of morphine under the specified conditions.

In the characteristic reaction a pink or red color is obtained, often changing soon to yellow or brown, as the red compound is rather unstable. It is probable that a compound of copper with the phenol is formed, so that the action of the copper is not merely "catalytic," as is generally assumed.

Some phenols are very sensitive to copper and by using such a one this reaction may be made a test for copper. Directions are given, and reactions shown for various proportions of copper, with morphine, thymol, 4-hydroxy 1, 2-dimethyl benzene, and resorcin. Morphine will detect about 1 part of copper in 3,000,000 of solution, the others about 1 part in 1,000,000.

ACCELERATED PRODUCTION OF SPECIFIC URINARY PIGMENTS BY DRUG ADMINISTRATION*

II. EFFECT OF DIETHYLSULFONMETHYLETHYLMETHANE ON UROBILIN AND UROBILINOGEN FORMATION

By Frederick G. Germuth, F. C. S.

Division of Research, Bureau of Standards, City of Baltimore

Introduction

PREVIOUS work undertaken by the author (1) and considered in the first of this series of researches dealing with the effect of certain synthetic compounds upon specific pigment formation of biliary origin—has shown that phenyldimethylpyrazolon affects in a most pronounced manner the proportion of urobilin existing in the body fluid, urine.

The observation, too, has been made that the hypnotic, diethylsulfonmethylethylmethane exerts an appreciable influence on the production of many urinary compounds, both of organic and inorganic structure, some of which are increased in amount while others show a decided decrease in the proportion encountered in the clinical examination of normal urines (2). It is obvious that any marked alteration occurring in the quantities of bodies of the character considered must be accorded due recognition and consideration by the diagnostician in order to insure correct interpretation of prevailing conditions, upon which diagnosis and prognosis are so frequently based. It was considered, therefore, desirable to endeavor to ascertain to what extent Trional might be guilty of engendering and facilitating the production of the pigments, urobilin and urobilinogen.

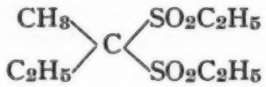
Familiarity with the fact that the synthetic is so widely employed in the treatment of diseases of the nervous system, insomnia, etc., and further, that it is possible for the layman in most of the States, because of lack of legislation, to obtain by purchase any quantity of the sulfone that may be desired—a most deplorable state of affairs—seemed to render further investigation of the pathological effects of this compound of practical significance and importance.

*Presented before the Division of Medicinal Chemistry at the Eighty-first Meeting of the American Chemical Society, held in Indianapolis, March 30-April 3, 1931.

Historical

The therapeutic effect of the sulfone, Trional, was first accidentally discovered by Baumann and Kast (3), but was later subjected to scientific investigation. Many interesting facts concerning the effect of substitution by hydroaromatic, aromatic, carboxyl and amino groups in the molecule have been subsequently made known by various workers (4), while the superiority of the ethyl linkage over the methyl group in the sleep-producing properties of this series of compounds has received attention and become ultimately established.

Diethylsulfonmethylethylmethane possesses the structural formula:



As is evident, the synthetic differs from Sulfonal in that the C_2H_5 group has replaced the second methyl radical, constituting a change in the alkyl linkage obtaining in the molecule.

The fact that the urinary pigment, hæmatoporphyrin, stands in close relationship with the compounds urobilin and urobilinogen, is generally recognized. Several investigators (5) have obtained, by the action of certain reducing substances, pigments quite similar in composition to urobilin, while Mencki and Rotschy (6) have proved conclusively that hæmatoporphyrin introduced into the body of the rabbit will in part be transformed into the former compound.

The proportion of each of these pigments is increased in hemorrhage, and in diseases characterized by the destruction of blood corpuscles as occurs after continued employment of certain blood-poisons, such as acetanilid and antipyrine (1). An acceleration in the production of these bodies also obtains in fevers, cardiac diseases, lead colic, and atrophic cirrhosis of the liver; they are particularly abundant in so-called urobilin icterus (7).

Urobilinogen is identical with hemibilirubin, and is colorless; the combined action of atmospheric air and light readily causes its oxidation to urobilin.

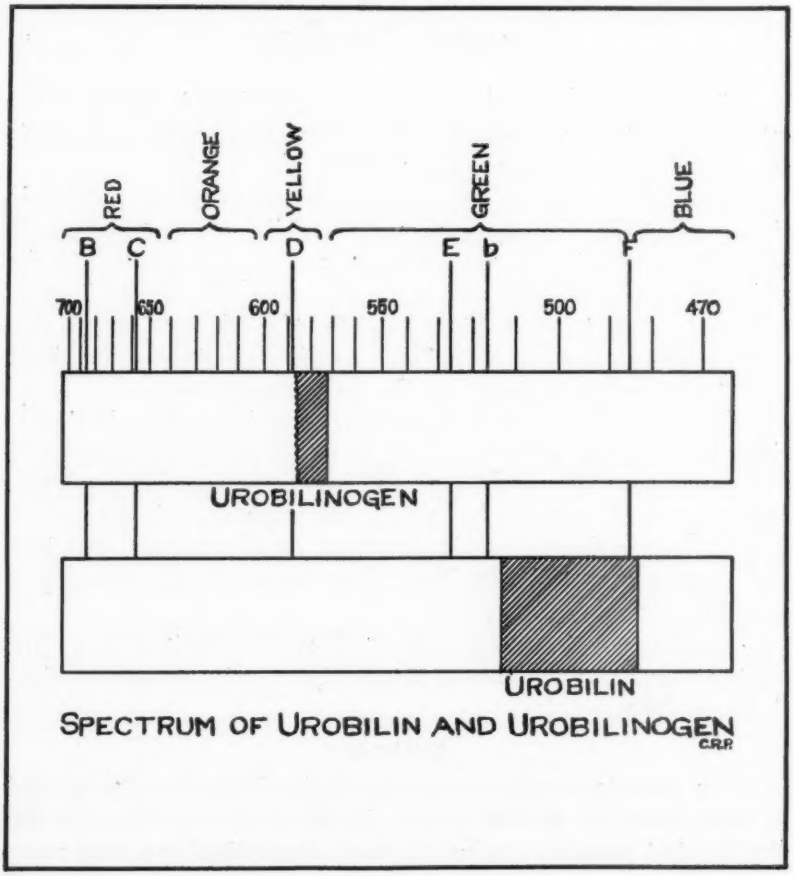
Methods

The procedure recommended by Hoppe-Seyler (8) was utilized in determining the urobilin present in the normal as well as in the physiological samples of urine, the method constituting a most accu-

rate means of estimating this constituent. As this particular method is furnished in detail in the first paper of the present series (1), it will be omitted here.

Urobilinogen was determined spectroscopically by the method of Charnas (9), employing Ehrlich's reagent (p-dimethylaminobenzaldehyde).

To eliminate the possibility of failure to discern any defect accruing in the final results by the introduction of inadvertent error in making the essential examinations, it was considered desirable to endeavor to confirm the data so obtained by the application of some other reliable means of ascertaining the proportion of the urinary pigments present in the samples of urine. This desideratum was accom-



SPECTRUM OF UROBILIN AND UROBILINOGEN
C.R.P.

plished by the employment of a method (10) which is widely used in routine determinations of the pigments in numerous clinical laboratories. Ehrlich's reagent is also utilized here in conjunction with a Hellige colorimeter with spectroscope attachment.

The presence of urobilin is marked by a broad band in the blue end of the spectrum. The violet rays are completely absorbed and, in the presence of an excess of this compound, most of the green may be obliterated. Urobilinogen absorbs a narrow portion of the spectrum in the yellow at the edge of the green (see Spectrum of Urobilin and Urobilinogen) and, if present in large amounts the band may be sufficiently broad to obscure the entire yellow portion of the spectrum. It is located by its proximity to the "D" Fraunhofer line, whilst that of urobilin extends from between "b" and "F" lines to the violet end of the visible spectrum. The urobilin and urobilinogen bands differ greatly in their intensity (11). It is of interest to note in this connection that the red color due to the latter can be extracted with isoamyl alcohol; urobilin does not exhibit this reaction, which, incidentally, is common to certain hæmetin and pyrrol derivatives.

Results attained by applying the procedures described were found to be practically identical with those previously observed following the application of the methods first utilized.

Experimental

Every precaution was observed during the experimental portion of this work to avoid discrepancies due to an imperfect knowledge of the pathological conditions affecting the patients from whom the samples of urine were obtained. As has been shown, an increase in the proportion of the pigments under consideration occurs in the presence of certain diseases; every effort was made to insure the acceptance of experimental and control urines known to have been voided by inmates whose hospitalization did not include treatment involving the use of any other substance known to be capable of influencing the mechanism by which systemic production of the urinary bodies is controlled.

Ten samples of the body-fluid, representing the total amount voided by the patient during the period of twenty-four hours, and for whom Trional had been prescribed in dosages of fifteen grains per day consecutively for seven days, were collected daily and examined on the eighth day. During the interim, each of the samples was placed in a

special bottle, exhausted of air, sealed, and kept in total darkness. The addition of a small quantity of 1:3:4 hydroxycymene to the contents of each bottle was made prior to storage. Ten additional samples of normal urine were also maintained under similar conditions; these were derived from patients to whom the aliphatic compound had not been administered—at the end of the stipulated period the samples were subjected to the inspection accorded the physiological urines. Tables I and II furnish the results obtained by careful examination of the samples of normal urine.

TABLE I—DETERMINATION OF UROBILIN IN NORMAL URINE

Amount expressed in mg. per liter

Sample No.	1	2	3	4	5	6	7	8	9	10
Quantity	75	69	86	61	93	74	98	62	81	79

Average—78 mg.

TABLE II—DETERMINATION OF UROBILINOGEN IN NORMAL URINE

Amount expressed in mg. per liter

Sample No.	1	2	3	4	5	6	7	8	9	10
Quantity	32	29	28	41	36	49	38	51	40	35

Average—38 mg.

The samples of urine representing those patients to whom the medicinal had been administered were next submitted to chemical examination, and the data obtained as given in Tables III and IV.

TABLE III—DETERMINATION OF UROBILIN IN PATHOLOGICAL URINE

Amount expressed in mg. per liter

Sample No.	1	2	3	4	5	6	7	8	9	10
Quantity	132	138	121	146	184	175	207	188	135	157

Average—158 mg.

TABLE IV—DETERMINATION OF UROBILINOGEN IN PATHOLOGICAL URINE

Amount expressed in mg. per liter

Sample No.	1	2	3	4	5	6	7	8	9	10
Quantity	49	43	38	54	51	47	63	55	59	68

Average—53 mg.

Remarks

Consideration of the compiled results given in the foregoing tables renders valid the belief that continued ingestion of diethyl-

sulfonmethylethylmethane over comparatively short periods tends to promote the process by which disintegration of erythrocytes occurs; an anticipated excess in the proportions of urobilin and urobilinogen in the body-fluid ensues. As has been stressed, this condition is also encountered in certain pathologic states; however, the acceleration in the production of the pigments in these specific forms of illness is not so pronounced as is that obtaining when the sulfone is administered.

Summary

(1) Administration of diethylsulfonmethylethylmethane over a period of seven days increases to a marked extent, the proportion of urobilin existing in urine.

(2) Under similar conditions, the quantity of urobilinogen is present in excess of the normal amount; the increase is not so great as that observed in urobilin.

(3) Data are given, showing the comparative amounts of the urinary compounds present in normal and physiological urines.

REFERENCES

(1) Germuth: *J. Am. Pharm. Assn.*, 19, 132-5 (1930).
(2) Germuth: *Am. J. Pharm.*, 102, 653-8 (1930).
(3) Baumann and Kast: *Z. physiol. Chem.*, 14, 52 (1890).
(4) Hildebrandt: *Arch. exp. Path. Pharm.*, 53, 90 (1905); Posner: *Chem. Ztg.*, 29, 1107 (1905).
(5) Hoppe-Seyler: *Med. Chem. Unters.*, p. 533; MacMunn: *Proc. Roy. Soc.*, 30, and *J. Physiol.*, 10.
(6) Mencki and Rotschy: *Monatsch. f. Chem.*, 10.
(7) Hammarsten and Hedin: *Textbook of Physiological Chemistry*, 8th German Ed., p. 745.
(8) *Virchow's Arch.*, 124.
(9) Charnas: *Bioch. Zeitschr.*, 20.
(10) Boyd: *J. Lab. and Clin. Med.*, 4, 495 (1919).
(11) Haden: *Clinical Laboratory Methods*, 2d Ed., p. 74.

MEASUREMENT OF THE RADIATION OUTPUT OF ULTRA VIOLET LAMPS

By Ellery H. Harvey

Introduction

INTEREST in the possible relationship between the quality and quantity of artificial sources of ultra violet, in connection with the development of physiological response, and direct methods of chemical analysis, continues unabated, although the promiscuous self-dosage with ultra-violet light by the lay public seems to have passed the peak. Of the chemical methods proposed that based on the sensitivity of uranium salts to ultra violet, first reported by Bucholz in 1806, has been a favorite.[1]

Research in this field by the writer over a period of years, looking to the development of newer and better methods, leads him to advance the following as having possible merit:

Method

The entire contents of one ampul of Iodipin,[2] about 2 cc., is spread over the bottom of a 3½ in. tared Petri dish and weighed by difference. This is irradiated for 15 minutes at a distance of 12 inches from the source and washed into a beaker with carbon tetrachloride. Water, potassium iodide solution and hydrochloric acid are added and the free iodine titrated with a very dilute standard sodium thiosulphate solution in the usual manner, using starch solution as indicator. Under the conditions named the number of milligrams of iodine liberated per gram of Iodipin is a measure of the total ultra violet output of the lamp under investigation.

[1] For a review see Harvey: *J. A. Ph. A.*, 19, 1173-79 (1930).

[2] Forty per cent. Iodine in organic combination with sesame oil; marketed by Merck as a contrast medium in myelography for detecting urethral strictures.

Application

Measurements were made using the tungsten-mercury lamps now popular, the unit having a transformer in the base and operating on 110 volt A. C. These lamps, known as Mazda S_1 and Mazda S_2, were mounted in 9½ inch diameter aluminum reflectors with matt surface. The aluminum cap which fitted over the bottom of the lamp was removed.

TABLE I

Lamp	Irradiation Time (min.)	Milligrams of Iodine Liberated per gram
S_2	5	0.06
S_2	15	0.18
S_2	25	0.30
S_1	15	0.35

These results prove the amount of iodine liberated is a linear function of time and that the S_1 type of lamp is twice as potent as the S_2 under identical conditions.

Using the same technique, the carbon arc type of lamp was investigated, the intentional variable being, except as noted, the different metallic mixtures used in the cores. The protective wire screen was removed in each instance. Irradiation was kept constant at 15 minutes, using the same matt surfaced aluminum reflector, 110 volt A. C. and every precaution to keep the carbons the same distance apart. Because of the difficulty in controlling all factors, the tabulated figures must not be taken too seriously in generalizing:

TABLE II

Type Carbon	Diam. of Carbon (mm.)	Milligrams of Iodine Liberated per gram
Sunshine	8	0.252
C	8	0.234
E	8	0.222
K	6	0.132
Supertan	7	0.165

Due to an exhaustion of materials the effect of size in the same type of carbon was not determined. Comparing the data on the 8 mm. carbons, one is impressed with the similarity of results. Unless differences of two in the second decimal place have considerable significance, there does not appear to be the quantitative differences between the carbons one has been led to believe, nor do the differences of potency, such as they are, run in the advertised direction. The 8 mm. carbons occupy an intermediate position between the S_1 and S_2 type lamp.

987 Ridgewood Drive,
Highland Park, Ill.
July, 1932.

MEDICAL AND PHARMACEUTICAL NOTES

SODIUM FLUORIDE POISONING—Treatment: The important consideration in the treatment of sodium fluoride poisoning is the employment of calcium-containing substances in order to convert the soluble sodium salt to insoluble calcium fluoride. This is best accomplished by copious, repeated gastric lavage with lime water or a weak solution of calcium chloride and by the intravenous injection of calcium chloride or intramuscular injection of calcium gluconate.

Summary and conclusions:

1. Sodium fluoride is widely used in this country as an insecticide. Despite the fact that many fatalities have occurred following its accidental substitution for saline laxatives and baking powder, it is still widely dispensed without any indication that it is a poisonous substance.

2. One fatal case and seven nonfatal cases of accidental sodium fluoride poisoning were encountered at the Miami Valley Hospital, Dayton, within one month. The fatality resulted from the accidental substitution of sodium fluoride for epsom salt. The nonfatal cases resulted from the accidental substitution of sodium fluoride for baking powder in the preparation of biscuits. Since the labels on containers of insect powders containing sodium fluoride give no indication of its poisonous properties, such containers are commonly kept in medicine cabinets and in kitchen cupboards.

3. The toxic properties of sodium fluoride are not generally appreciated, largely because of the inadequate information, or misinformation, contained in textbooks on toxicology.

4. The urgent necessity for the proper labeling of containers of sodium fluoride-containing insecticides is apparent.—(Drs. Sharkey and Simpson: *Jour. A. M. A.*, Jan. 14, 1933.)

LABEL BORIC ACID SOLUTIONS POISON—The recent deaths of three infants by the accidental use of boric acid in a New York hospital recalls six similar accidents in a Chicago hospital in 1927

(McNally, W. D., and Rust, C. A.: The Distribution of Boric Acid in Human Organs in Six Deaths Due to Boric Acid Poisoning, *The Journal,* Feb. 4, 1928, p. 382). All these accidents occurred as the result of administering a solution of boric acid for water or saline solutions. The use of boric acid and its salts in the medical profession and in some of the economic lay industries has made them commonplace—so much so, in fact, that their power for harm through overdosage or accidental consumption has receded to the background until ordinary precaution, at times, is not used in administering these substances. The potential danger of boric acid poisoning is sufficiently great to make it imperative that all containers of solutions of boric acid in hospitals be distinctly labeled poison, so that there will not be a repetition of this type of poisoning.—(W. D. McN., *Jour. A. M. A.,* Jan. 7, 1933.)

ANTISEPTIC, DISINFECTANT AND RELATED WORDS *—Study of what is a fair use of the terms when applied to manufactured products. In an article on this subject, Austin M. Patterson, Ph. D. (*Amer. Journ. Public Health,* May, 1932), points out that the use of technical and semi-technical words in commerce has increased rapidly with the development of research and the growth of advertising.

In this article definitions and comments are presented for the following terms: antiseptic, bactericidal, bactericide, deodorant, deodorize, disinfect, disinfectant, disinfection, disinfest, germicidal, germicide, insecticidal, insecticide, prophylactic, sterilization and sterilize.

It has been announced as a principle of legal practice that "language used in the label is to be given the meaning ordinarily conveyed by it to those to whom it is addressed." This commends itself as a sound and wise ruling, for the general public cannot be expected to be acquainted with special technical meanings or to have information proper to experts alone. Nevertheless, it is possible to draw wrong conclusions from this principle. People constantly make use of words of which they do not know the accurate meaning. They know

*The investigation was conducted with the aid of a grant from the Insecticide and Disinfectant Manufacturers' Association.

barely enough about it for ordinary purposes; the rest they leave to the specialist. This is eminently true of such things as drugs and medicaments. It is small wonder that similar terms are sometimes confused in the popular mind. But the mere fact that the average person has a confused notion of a word which is used correctly by writers and careful speakers does not justify acceptance of the confused meaning.

The terms *antiseptic* and *disinfectant* may be taken as examples. There appears to be some haziness in the mind of the public regarding their signification; yet the greater part of the literature is in fair agreement as to the derivation, history, and present meaning of the two words. Moreover, what popular confusion may exist is not so much with respect to the *root idea* of the words ("antiseptic," opposing decomposition; "disinfectant," ridding of infection) as regarding the mechanism by which the result is effected (removing germs, killing germs, or preventing the growth of germs). It is the result that chiefly concerns the public; the expert must be relied on for exact knowledge of the mechanism.

So far as the writer can determine, there do not seem to be serious differences of opinion among professional men as to the meanings of the various terms now under discussion. In so far as differences exist, they seem to relate rather to the question as to what is a fair use of the terms in connection with certain manufactured products, when the circumstances under which these products are to be used are duly considered.

For example, there seems to be pretty general agreement that the term *antiseptic* (at least aside from surgery) may properly be applied to a substance which merely arrests the growth of microorganisms without killing them. There is apparently no question, for example, as to advertising a bandage impregnated with iodoform as an antiseptic dressing for wounds or as to calling iodoform or any similar agent an antiseptic when so used. The question seems to be whether a substance which is not a germicide but which acts as an antiseptic so long as it remains in contact with the area to be protected can fairly be called an antiseptic when its application is necessarily brief as in the case of a mouth wash, gargle or tooth paste.

Again, the agreement on the meaning of the term *prophylactic* seems to be good. It is recognized as a very broad term. Apparently the main question at issue, if there is one, is under what circumstances a given substance may fairly be claimed to have a prophylactic effect.

The adjustment of such questions as to what is fair under different circumstance seems to lie outside the province of definite meanings of words. It seems to be a matter of bacteriological and medical knowledge, a spirit of fair play, and good common sense. The writer hazards a suggestion that, since the correct application of certain terms of which *antiseptic* and *disinfectant* may serve as types depends on a number of factors (in the present case, strength, time of contact, type of organism, etc.), due regard should always be had to these factors as they occur, or are likely to occur, in actual practice.—(Merck's Report, January, 1933.)

Is the "Appalling Increase" in Heart Disease Real—Under this title C. F. Bolduan and N. S. Bolduan present in the *Journal of Preventive Medicine,* July, 1932, the results of a study of the mortality statistics of New York City covering the past thirty years.

Their conclusions follow:

1. In New York City, for the population as a whole, there is no evidence of any increase in the real death rate from heart disease.

2. The registered rise in the death rate from heart disease is largely, if not wholly, fictitious.

3. Statistics based on the registered deaths from heart disease alone are fallacious. Deaths registered under apoplexy, arterial disease, kidney disease and senility must be taken into account.

4. The great prevalence of cardio-arterio-renal disease presents a very important health problem. Its solution demands accurate statistics.

5. In the United States registration area as well as in New York City the specific death rates even in the higher age group have declined since the beginning of the century, a fact which it is difficult to reconcile with any considerable increase in the mortality of heart disease.

6. A detailed statistical study of the course of the death rate from cardio-arterio-renal disease in the United States registration area should be made, due consideration being given in such a study to the various sources of error discussed in this paper.

Poison Gas Stimulates Plants to Form New Roots—Carbon monoxide, notorious as a poisoner of incautious motorists who start engines in closed garages, can play an opposite and beneficial role for propagators of plant cuttings. It has a specific action on plant tissues, causing them to sprout new roots in shorter time, or even to produce roots where otherwise no roots would grow at all.

Researches by which this fact was demonstrated were reported before the physiological section of the Botanical Society of America by Drs. P. W. Zimmerman, William Crocker and A. E. Hitchcock, of the Boyce Thompson Institute for Plant Research.

A wide variety of plants, both woody and herbacious, were tried. Among others were tobacco, marigold, balsam and hydrangea. New roots were induced to form on young portions of the stems of all plants tried, and on three of them roots even formed on the leaves.

In addition to stimulating the formation of entirely new roots, the gas also spurred into vigorous activity the already existing beginnings of roots in twenty different plant species.

The gas was effective over a wide range of concentrations ranging from 0.05 per cent. to 50 per cent. The time of exposure necessary to induce the response varied with the species from two days to twenty.

Three other gases, acetylene, propylene and butylene, have been found effective for inducing roots to form somewhat as reported for carbon monoxide.—(*Science News.*)

Growth of Plants Stimulated by Proper X-Ray Treatment—X-rays can cause plants to grow faster, blossom earlier, form more chlorophyll, and in general speed up their life processes. But if they get too much of a dose of the rays, they become cripples.

This in brief summary is what Professor Charles A. Shull, of the University of Chicago, has found in experiments which he reported before the meeting of the American Society of Plant Physiologists.

Professor Shull exposed corn, wheat, oats and sunflowers to X-rays for periods of from one to five minutes inclusive, under screens to take out the harmful parts of the X-ray spectrum, and also for ten minutes without the benefit of screening. He compared

the growth of these plants with "control" plants that were not X-rayed at all.

All the rayed plants except the ten-minute lot apparently were stimulated by the treatment. In some cases they became juicier, or more succulent, as well as larger. In corn a considerable increase of the green food-making substance, chlorophyll, was noted, running from 20 to 60 per cent. above the controls. X-rayed seeds carried on their respiratory processes with greater energy, the data indicating from 30 to 50 per cent. increase—(*Science News.*)

Coal Tar Cancer—The exact chemical nature of the substance in coal tar which produces cancer has been discovered. The substance itself has been produced synthetically in the laboratory. This important success, following many years of failure, has just been reported to *Nature* by Dr. J. W. Cook, I. Hieger and Hewett, of the Cancer Hospital Research Institute in London.

One type of cancer, which often afflicts chimney sweeps and workers in the coal tar industries, is due to irritation with coal tar, scientists found some time ago. The same type of cancer occurs in mice that have had coal tar painted on the skin. Now the British investigators have found that the cancer-producing constituent of the coal tar is a previously unknown compound of hydrogen and carbon, 1.2 benzpyrene.

Samples of this compound which they made in the laboratory were as effective as material isolated from pitch in producing cancer of the skin in mice. The rapidity with which this synthetic compound caused skin cancer in mice indicated that it is the most active cancer producing hydrocarbon known. Ordinarily it takes some time for the coal tar cancers to be produced.

The cancer-producing benzpyrene was isolated by concentrating active fractions of coal tar pitch using a method of fluorescence spectroscopy developed by Mr. Hieger and W. V. Mayneord. The synthetic material was produced from pyrene, a complex hydrocarbon isolated from coal tar, but not to be confused with the popular fire extinguisher which has the trade-name of pyrene and is carbon tetrachloride.

While the identification and synthetic production of this substance responsible for one type of cancer has no immediate bearing

on discovery of a cure for the disease, it should be a great aid to cancer research.

In the course of their study, the investigators also isolated from coal tar pitch three other hitherto unrecognized coal tar constituents and identified one of them by synthesis. These are two hydrocarbons composed entirely of benzene rings, namely perylene and 4.5 benzpyrene, and one other compound, 1.2 benzanthracene from the chrysene fraction of coal tar. The 4.5 benzpyrene, which is closely related to the cancer-producing substance, was the one synthesized. —(*Science News.*)

Concentrated Solution of Hydrogen Peroxide—Few pharmacists are aware of the availability of a commercial solution of hydrogen peroxide in a concentration ten times that of the official solution. This so-called 100-volume peroxide, largely used in the bleaching of textiles, may be purchased in quantity at about eighteen to twenty cents a pound, thus, with water dilution to the proper strength, affording an official peroxide (10 volumes 0, 3 per cent. H_2O_2) at about fifteen cents per gallon.

The addition of a stabilizer (acetanilid) hardly seems necessary in view of the fact that the original concentrate is well stabilized with well chosen preservatives.

NEWS TEMS AND PERSONAL NOTES

AMERICAN PHARMACEUTICAL ASSOCIATION OFFICERS ELECT FOR 1933-34.—The Board of Canvassers of the American Pharmaceutical Association, composed of W. Paul Briggs, chairman, and Morris Goldstein, Washington, D. C., and Walter S. Nicklin, Alexandria, Va., has announced as the result of the mail ballot for officers of the association the election of the following:

President, Robert L. Swain, Baltimore, Md.
First vice-president, Robert P. Fischelis, Trenton, N. J.
Second vice-president, John C. Krantz, Jr., Baltimore, Md.

Members of the Council (for three years), W. D. Adams, Forney, Texas; H. V. Arny, New York, N. Y.; H. C. Christensen, Chicago, Ill.

These officers will be installed at the next annual meeting of the association which will be held in the Hotel Lorraine, Madison, Wisconsin, during the week of August 28th to September 2d, 1933.

PROSPECTS FOR. 1933—George W. Merck, president of Merck & Co., Inc., manufacturing chemists, Rahway, N. J., in commenting on the prospects of this particular industry for 1933, stated:

A mild epidemic of influenza during December resulted in a slight increase in the sale of chemicals used in combating this particular disease. Naturally the question of whether this increase in sales will continue during the first few months of 1933 is a matter of conjecture. Looked at from almost every angle, the bulge cannot be considered other than temporary.

During the year 1932 the industry suffered severely in dollar volume reduction, but fortunately this decrease was not as severe as in most industries. Up to the present time there have been no definite indications that the year 1933 will show an upturn in volume. The period of depression has been accompanied by a betterment in the physical well-being of the country, which in turn has resulted in fewer calls for medicinal chemicals.

Most manufacturers in the industry, rather than count on increased volume during 1933 on their present products, are bending every effort in developing through research new products and new uses for their present products.

In line with this procedure, Merck & Co., Inc., during the past year, intensified considerably their research efforts and facilities, and it is hoped that some of the efforts expended in this direction during 1932 will be fruitful of results in 1933. The Merck Research Laboratory, to house twenty-five research chemists, and costing over $150,000, will be ready for occupancy on the first of March. Included in the additions in personnel made to the research staff recently is Dr. Hans Molitor, who was considered one of the foremost pharmacologists of Vienna. Dr. Molitor will direct pharmacological research.

Also in their search for new products Merck & Co., Inc., is collaborating very closely with the medical laboratories of a few of the leading universities of the country.

SCHEDULE OF POPULAR SCIENCE LECTURES FOR 1933

Philadelphia College of Pharmacy and Science

Wednesday Evening, February 1st, 8.30 P. M.
"The Triumphs of Surgery" .....By Dr. Wilmer Krusen

Wednesday Evening, February 8th, 8.30 P. M.
"Spinning Tops" .....By Dr. George Rosengarten

Wednesday Evening, February 15th, 8.30 P. M.
"The Eternal Grind" .....By Prof. C. C. Pines

Wednesday Evening, February 22d, 8.30 P. M.
"Platinum, the Versatile Element" .....By Prof. Arthur Osol

Wednesday Evening, March 1st, 8.30 P. M.
"Eating in All Languages" .....By Dean Charles H. LaWall

Wednesday Evening, March 8th, 8.30 P. M.
"Silver Threads Among the Gold" .....By Prof. Ivor Griffith

Wednesday Evening, March 15th, 8.30 P. M.
"Water, the Fluid of Life" .....By Prof. Arno Viehoever

Wednesday Evening, March 22d, 8.30 P. M.
"The Air We Breathe" .....By Prof. Louis Gershenfeld

Wednesday Evening March 29th, 8.30 P. M.
"Poisonous Metals" .....By Dean J. W. Sturmer

Wednesday Evening, April 5th, 8.30 P. M.
"The Science of Modern Laundering" .....By Prof. D. W. Horn

BOOK REVIEWS

ORGANIC CHEMISTRY. By G. Albert Hill, Professor of Organic Chemistry of Wesleyan University, and Louise Kelly, Professor of Organic Chemistry, of Goucher College. P. Blakiston's Son and Company, Inc., 1012 Walnut Street, Philadelphia, 1932. 564 pp. Cloth. Price, $3.00 net.

In the words of the preface, "This text is planned for an elementary, but comprehensive, one-year course in organic chemistry. It provides a survey of the subject for the student who will go no further in the study of organic chemistry, and establishes a foundation" for those who will take up additional work.

Beginning with a chapter giving a "Historical Background of Organic Chemistry," the authors carry the student through thirty-eight chapters covering the groupings of organic compounds essentially as found in most of the many books on organic chemistry now on the market. In the development of the subject not a great deal of emphasis is put upon nomenclature and formula writing. Classes of compounds and individual substances are considered more from the viewpoints of source, manufacture, physical and chemical properties, and uses. Chemical processes are freely illustrated by means of equations and diagrams. Each chapter closes with a series of "Problems," the solution of which requires considerable thought on the part of the student.

The language of the text is concise, yet clear, and the data given shows that the authors are familiar with many of the newest products and processes. Paper, printing and binding leave little to be desired, and the proofreader did his work well. Twenty-seven pages of double-column index are worthy of commendation.

The volume should accomplish admirably the purposes of its authors.

F. P. Stroup.

AN INTRODUCTION TO ORGANIC CHEMISTRY. By Ira D. Garard, Ph. D., Professor of Chemistry in the New Jersey College for Women, Rutgers University. John Wiley and Sons, Inc., 440 Fourth Avenue, New York. 1932. 296 pp. Cloth. Price, $2.75 net.

According to the preface, "this book has been designed especially for those introductory courses in organic chemistry which extend over just one semester"; hence, "emphasis has been laid on the more fundamental reactions and on the groups of compounds of greatest importance to" students who may not receive any other training in the subject. Accordingly, "many reactions of great importance in organic syntheses have been omitted" and "a rather thorough study of a relatively small field" has been undertaken.

Each of the sixteen chapters of text closes with a series of six to about fifteen so-called "Problems for Study," many of which cannot be satisfactorily solved without the aid of some collateral reading.

Chapter xvii ("Introduction to Experimentation") details twenty-eight "Experiments," each designed to "illustrate a common and important principle, or familiarize the student with the nature of a common organic substance."

Structural formulas are freely used throughout the book, the text is good as to both language and printing, there is a good index, and serious errors appear to be absent.

Students in agriculture, biology, home economics, pre-dental and pre-medical courses, who are limited as to time, should find the volume very useful.

F. P. Stroup.